extensive, and the spleen is of larger dimensions and greater elasticity.

The splenic corpuscles are thickly scattered throughout the cellular parenchyma of this organ; and from each corpuscle there arises a minute lymphatic vessel; the interlacing of adjacent lymphatics giving rise to a fine and extensive net-work. The trunks of these vessels enter into the Malpighian glands, and again ramifying, form a lymphatic plexus in the interior of these bodies. The fluid contents of these vessels, which had been before pellucid, is now found to contain white organic globules, similar in every respect to those observed in the fluid of lymphatic glands in other parts of the body. The author considers the secretion of this fluid, which appears to be identical with the contents of the lymphatic glands, as being the peculiar function of the splenic parenchyma.

A few illustrative drawings and diagrams accompany this paper.

2. "On the Structure and Developement of the Nervous and Circulatory Systems, and on the existence of a complete Circulation of the Blood in Vessels in the Myriapoda and the Macrourous Arachnida." By George Newport, Esq. Communicated by P. M. Roget, M.D., Sec. R.S.

This paper is the first of a series which the author proposes to submit to the Royal Society on the comparative anatomy and the developement of the nervous and circulatory systems in articulated animals. Its purpose is, in the first place, to investigate the minute anatomy of the nervous system in the Myriapoda and the Macrourous Arachnida, and more especially with reference to the structure of the nervous cord and its ganglia; and thence to deduce certain conclusions with respect to the physiology of that system and the reflex movements in vertebrated animals; secondly, to demonstrate the existence of a complete system of circulatory vessels in the Myriapoda and Arachnida; and thirdly, to point out the identity of the laws which regulate the developement of the nervous and circulatory systems throughout the whole of the Articulata, and the dependence of these systems on the changes which take place in the muscular and tegumentary structures of the body, as, in a former paper, he showed was the case with regard to the changes occurring in the nervous system of true insects.

The first part of the paper relates to the nervous system. A description is given of this system in the Chilognatha, which the author was led, by his former investigations, to regard as the lowest order of the Myriapoda, and approximating most nearly to the Annelida. He traces the different forms exhibited by the nervous system in the principal genera of that order, the most perfect of which are connected on the one hand with the Crustacea, and on the other with true insects. Passing from these to the Geophili, the lowest family of the Chilopoda, which still present the vermiform type, the nervous system is traced to the tailed Arachnida, the Scorpions, through Scolopendra, Lithobius and Scutigera; the last of which tribes connects the Myriapoda on the one hand with the

true insects, and on the other with the Arachnida. The brain and the visceral nerves, the coverings and structure of the cord and ganglia, and the distribution of the systemic nerves are examined in each genus, but more particularly in the Scorpion, in which the nerves of the limbs are traced to the last joints of the tarsi, and those of the tail to the extremity of the sting. Especial attention is bestowed on the structure of the cord and its ganglia, and their developement during the growth of the animal. In the lowest forms of the Iulidæ, in which the ganglia are very close together, and hardly distinguishable from the non-ganglionic portions of the cord, the author has satisfactorily traced four series of fibres, a superior, and an inferior one, and also a transverse and a lateral series. The superior series, which he formerly described in insects as the motor tract, he has assured himself is distinct from the inferior, which he regarded as the sensitive tract; this evidently appears on examining the upper and under sides of a ganglionic enlargement of the cord. On the upper surface the direction of the fibres is perfectly longitudinal; while the fibres on the under surface are enlarged, and curvilinear in their direction. But he remarks that it is almost impossible to determine by experiment whether these structures are separately motor and sensitive, as formerly supposed, or whether they both administer to these functions by an interchange of fibres. These two series appear also to be separated in each ganglionic enlargement of the cord by the third series, constituting the transverse or commissural fibres, which pass transversely through the ganglia, and of which the existence was first indicated by the author in his paper on the *Sphinx ligustri*, published in the Philosophical Transactions for 1834. The author states that, in addition to these, there is in each half of the cord another and more important series of fibres, which constitute a large portion of the cord, but of which the existence has hitherto entirely escaped observation. This series forms the lateral portion of each half of the cord, and differs from the superior and inferior series in the circumstance, that while those latter series are traceable along the whole length of the cord to the subœsophageal and cerebral ganglia, the former series extends only from the posterior margin of one ganglion to the anterior margin of the first or second beyond it; thus bounding the posterior side of one nerve and the anterior of another, and forming part of the cord only in the interval between the two nerves. From this circumstance, the author designates the fibres of this series, *fibres of reinforcement of the cord*. Every nerve proceeding from a ganglionic enlargement is composed of these four sets of fibres, namely, an upper and an under one, communicating with the cephalic ganglia; a transverse or commissural, which communicates only with corresponding nerves on the opposite side of the body; and a lateral set, which communicates only with nerves from another ganglionic enlargement on the same side of the body, and which forms part of the cord in the interspace between the ganglia. The author had long suspected that this latter set of fibres existed; but he had never, until lately, ascertained their presence by actual observation. Their action seems fully to account for the re-

flected movements of parts both anterior and posterior to an irritated limb; as that of the commissural set does the movements of parts situated on the opposite side of the body to that which is irritated. In the ganglia of the cord in Iulus and Polydesmus, the fibres of the inferior longitudinal series are enlarged and softened on entering the ganglion, but are again reduced to their original size on leaving it; thus appearing to illustrate the structure of ganglia in general. In the developement of the ganglia and nerves in these genera, and also in Geophilus, the same changes take place as those which were formerly described by the author as occurring in insects; namely, an aggregation of ganglia in certain portions of the cord, and shifting of the position of certain nerves, which at first exist at ganglionic portions of the cord, but afterwards become removed to a non-ganglionic portion. The nervous cord is elongated, in order that it may keep pace with the growth of the body, which is periodically acquiring additional segments: that this elongation takes place in the ganglia is proved by these changes of position in the nerves lying transversely across the ganglia. The author infers from these facts, that the ganglia are centres of growth and nourishment, as well as of reflex movements, and that they are analogous to the enlargements of the cord in the vertebrata.

A series of experiments on the Iulus and Lithobius are next related; the result of which shows that the two supra-œsophageal ganglia are exclusively the centres of volition, and may therefore strictly be regarded as performing the functions of a brain: so that when these ganglia are injured or removed, all the movements of the animal are of a reflex character. When, on the other hand, these ganglia are uninjured, the animal movements are voluntary, and there exists sensibility to pain: there is, however, no positive evidence that the power of sensation does not also reside in the other ganglia.

The second part of the paper relates to the organs of circulation. In all the Myriapoda and Arachnida the dorsal vessel or heart is divided, as in insects, into several compartments, in number corresponding to the abdominal segments. Its anterior portion is divided, immediately behind the basilar segment of the head, into three distinct trunks. The middle portion, which is the continuation of the vessel itself, passes forwards along the œsophagus, and is distributed to the head itself; while the two others, passing laterally outwards and downwards in an arched direction, form a vascular collar round the œsophagus, beneath which they unite in a single vessel, as was first noticed by Mr. Lord in the Scolopendra. This single median vessel lies above the abdominal nervous cord, and is extended backwards throughout the whole length of the body as far as the terminal ganglia of the cord, under which it is subdivided into separate branches accompanying the terminal nerves to their final distribution. Immediately anterior to each ganglion of the cord, this vessel gives off a pair of vascular trunks; and each of these trunks is divided into four arterial vessels, one of which is given to each of the principal nerves proceeding from the ganglion, and may be traced along with it to a considerable distance. Of these, the vessel situated

most posteriorly is again connected with the great median trunk by means of a minute branch, so that the four vessels on each side form, with their trunks, a complete vascular circle above each ganglionic enlargement of the cord. Besides these, which may be regarded as the great arterial trunk and vessels conveying the blood directly from the anterior distribution of the heart to the limbs and inferior surface of the body, the author has also discovered a pair of large arterial vessels in each segment, originating directly from the posterior and inferior surface of each chamber of the heart. These vessels he has named *the systemic arteries*; and in the Scolopendra he has traced them from the great chamber of the heart, which is situated in the penultimate segment of the body, to their ultimate distribution and ramification in the coats of the great hepatic vessels of the alimentary canal.

After the blood has passed from the arteries, it is returned again to the heart in each segment of the body by means of exceedingly delicate transparent vessels, which pass around the sides of the segments and communicate with the valvular openings of each chamber of the heart at its upper surface, where the valvular openings are situated, not only in all the Myriapoda, but also in the Scorpionidæ. In Scorpions, the circulatory system is more complete and important than even in the Myriapoda. The heart, divided as in Myriapods into separate chambers, is lengthened out at its posterior extremity into a long caudal artery, and gives off a pair of systemic arteries from each chamber, precisely as in the Myriapoda. These arteries not only distribute their blood to the viscera, but send their principal divisions to the muscular structures of the inferior and lateral parts of the body, as well as to the pulmonary sacs. At the anterior part of the abdomen, the heart becomes aortic, descends suddenly into the thorax, and immediately behind the brain spreads out into several pairs of large trunks, which are given to the head, and to the organs of locomotion. The posterior of these trunks form a vascular collar around the œsophagus, beneath which they unite, anteriorly, to a strong bony arch in the middle of the thorax, to form the great arterial trunk, or supra-spinal vessel, which conveys the blood to the posterior part of the body, as in the Myriapoda. This vessel passes beneath the transverse bony arch of the thorax, and is slightly attached to it by fibrous tissue, which circumstance probably induced Professor Müller, who observed this structure in 1828, to regard it as a ligament. In its course backwards, along the nervous cord, this vessel is gradually lessened in size, until it arrives at the terminal ganglion of the cord in the tail, where it is divided into two branches, which take the course of the terminal nerves, and these are again subdivided before they arrive at their ultimate distribution. In addition to these parts, the author found a hollow fibrous structure, which closely surrounds the cord and nerves immediately after they have passed beneath the arch of the thorax. From the sides of this structure there pass off backwards two pairs of vessels, that get beneath the peritoneal lining of the abdominal cavity and are distributed on the first pair of branchiæ. A small vessel also

passes backwards beneath the cava, and, being joined by anastomoses from the spinal artery, form the commencement of a vessel which the author formerly described in the 'Medical Gazette' as the *subspinal vessel*. This vessel, extending along the under surface of the nervous cord, communicates directly, by short vessels, with the supra-spinal artery, and gives off, at certain distances from its under surface, several large vessels, which unite with others that convey the blood which has circulated through the abdominal segments, directly to the branchiæ, whence it is returned to the heart by many minute vessels that originate from the posterior internal part of each branchia, and, united into single trunks, pass around the sides of the segments to the valvular openings on the dorsal surface of the heart. In the tail of the Scorpion there is a direct vascular communication between the caudal artery and the subspinal vein, which, from the direction of the vessels, induces a belief that there is some peculiarity in the circulation of the blood in this part of the body. Besides these vessels, the author found an arterial trunk that originates from the commencement of the aorta as it descends into the thorax. This vessel passes backwards along the alimentary canal, to which it is distributed, and gives off branches to the liver.

This paper is accompanied by five drawings, illustrating the anatomical facts which are described in it.

The Society then adjourned over the Easter Recess to meet again on the 27th instant.

In consequence of the lamented death of H. R. H. the Duke of Sussex, the Society did not resume their Meetings till the 11th of May.

May 11, 1843.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

George Basevi, Esq., and Colonel John Le Couteur, were balloted for, and duly elected into the Society.

Edward Speer, Esq., was also balloted for, but not elected into the Society.

The following papers were read, viz.—

1. "Variations de la Déclinaison et Intensité Horizontale magnétique observées à Milan pendant vingt-quatre heures consécutives le 22 et 23 Mars, et le 19 et 20 Avril 1843." Par F. Carlini, For. Mem. R.S.

2. "Note regarding the Observations of T. Wharton Jones, Esq., F.R.S., 'On the Blood Corpuscles.'" By Martin Barry, M.D., F.R.S. L. & E.